

I. Restriction Requirement

Applicants elect, with traverse, to prosecute the invention of Group I, claims 1-25. Claims 26-31 have been cancelled without prejudice. Applicants reserve the right under 37 C.F.R. § 1.142(b) to prosecute claims 26-31 in a divisional application.

II. Drawings

Two substitute sheets of drawing FIGS. 7 and 8 are appended to this response. In each drawing figure, an inadvertant transcriptional omission has been corrected. The corrections to such drawing figures are shown in red ink on the substitute sheets. The specification has been amended accordingly.

The drawings have been objected to under 37 C.F.R. § 1.83(a). The Examiner states the reason for this objection as, "The drawings are objected to because a reference sensor is not shown." (Office Action dated 10/23/96, page 3). Claim 25 recites the "reference sensor". Claim 25 has been cancelled. Accordingly, Applicants believe that the objection to the drawings under 37 C.F.R. § 1.83(a) is overcome.

III. Allowable Subject Matter

The Examiner indicates that the subject matter of claim 24 is allowable. Claim 24 has been rewritten in independent form. Accordingly, Applicants believe that claim 24 is now in condition for allowance.

IV. Rejection Under 35 U.S.C. § 112, first paragraph

Claims 3-6, 12-16, 19-21, and 24 have been rejected under 35 U.S.C. § 112, first paragraph. The claimed invention relates generally to detection of radiation by monitoring radiation-induced changes in microcantilever behavior. Two radiation-induced effects are noted: heat and material change (damage, modulus change, stress, polymerization, etc.). These could also be classified as reversible (heat) or non-reversible (dosimetric).

Electromagnetic radiation can be detected according to the principles of the invention through radiation-induced heating effects; Applicants also demonstrate ultraviolet detection by irreversible radiation-induced changes to a polymer coating.

Nuclear radiation includes gamma radiation, which is electromagnetic radiation, and also alpha and beta radiation, which are particles. These latter two types of nuclear radiation, i.e., alpha and beta radiation, induce a significant amount of material damage to the absorbing material; this damage can be monitored through the mechanical resonance of a microcantilever according to the principles of the invention. Heating in this case is minimal (but not zero) for ordinary amounts of radiation. There are different ways to classify microcantilever interactions, but in each case there is a predictable response.

Claims 1-25 have been rejected under 35 U.S.C. § 112, first paragraph. The Examiner states, "There is no disclosure that would support detection of all types of electromagnetic radiation." All

electromagnetic radiation is absorbed, to some degree, by solid objects, including the claimed microcantilever, that are subjected to the radiation. Electromagnetic radiation covers the full gamut: subsonic frequencies - power-line frequencies - radio waves - microwaves - optical waves (infrared, visible, ultraviolet) - x-rays - gamma rays - cosmic rays. Certainly there are frequencies that absorb well in certain materials at certain frequency ranges; at other frequencies and for other materials, absorption is weak (but not zero). At low-to-mid frequencies, electric fields polarize conductive objects which create eddy currents which heat the material. The size of the material object is also important to optimize absorption; this deals only with efficiency. At optical frequencies and beyond, electronic and nuclear interactions absorb the radiation. All these types of absorption eventually produce heat, although some are less practical for present applications. Some also induce material changes (damage, modulus change, stress, polymerization, etc.). All are in principle detectable. Finally, note that sound waves are not classified as electromagnetic waves, as the Examiner states.

While the Examiner's comments have been carefully reviewed, the rejection is respectfully traversed. The specification is consistent with the claims. Applicants have disclosed at least four descriptive examples of the claimed invention in the specification, for infrared electromagnetic radiation, visible

electromagnetic radiation, ultraviolet electromagnetic radiation, and nuclear radiation.

In light of these remarks, Applicants believe that the rejection under 35 U.S.C. § 112, first paragraph is overcome.

V. Informalities

In claim 19, "on" has been changed to --one--. In claim 21, "surfae" has been changed to --surface--.

VI. Rejection Under 35 U.S.C. § 112, second paragraph

Claims 1-25 have been rejected under 35 U.S.C. § 112, second paragraph. This rejection is respectfully traversed.

Regarding the preambles of claims 1 and 17, the metes and bounds of the claims are clearly defined. Nuclear radiation includes gamma radiation, which is electromagnetic radiation, and also alpha and beta radiation, which are particles.

Regarding claims 4 and 5, and claims 3-7, 9, 10 and 12-17, in all occurrences throughout the claims under consideration "cantilever" has been changed to --microcantilever--.

Regarding claim 8, "PSD" means "position sensitive detector". This is described in the specification at page 17, line 22 through page 18, line 17, and at page 20, line 17 through page 21, line 3, and illustrated by item 48, FIG. 7, and item 96, FIG. 10. The signal from the position sensitive detector, PSD (e.g., item 48 in

FIG. 7), is based on the position of the reflected laser beam (e.g., item 46, FIG. 7).

Claim 22 has been amended to depend from claim 19. The "first metallic coating" recited in claim 19 is an antecedent basis for "a second coating" recited in claim 22.

In light of these remarks and the amendments made to the claims, Applicants believe that the rejection under 35 U.S.C. § 112, second paragraph is overcome.

VII. Rejection Under 35 U.S.C. § 102

Claims 1, 2, 5, and 17 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,427,881 to Ruell, hereinafter Ruell '881. This rejection is respectfully traversed.

In Ruell '881, "Due to the different temperature coefficients of expansion, the coatings 32 and 34 will bend the first light transmitting fiber 28, 30 in accordance with the sensed temperature T." (col. 5, lines 13-16). "Attached to the frame 42 is a rod 44 which serves to move the lens device 40 linearly under the influence of the physical parameter p. The parameter p to be measured may be, for instance, pressure or temperature." (col. 5, lines 31-35). Thus, Ruell '881 is directed to measuring temperature, pressure, or another unspecified parameter ("p"), but not radiation. Temperature is not the same thing as radiation.

Claims 1, 2, 4, 5, 7, 11, 12, 17-19, 22 and 23 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S.

Patent No. 4,762,426 to Foss, hereinafter Foss '426. This rejection is respectfully traversed.

Foss '426 "utilizes temperature or humidity sensors which require no electrical circuitry whatsoever and are read out by simple optical techniques to permit low cost sensing in remote or inaccessible areas." (col. 1, lines 16-20). Thus, Foss '426 is directed to monitoring temperature and humidity, but not radiation. Applicants claim detecting radiation. (See claims 1 and 17). Temperature and humidity are not the same as radiation. Temperature and humidity measurement are not analogous to the claimed invention.

"As the sensor temperature (or humidity for humidity sensor) changes, the reflectance of the corner cube changes such that the measured reflectance is then functionally related to the sensor temperature. To avoid absolute calibration problems of the reflectance caused by fogging or dirt on the corner cube, the cube contains the reference region 23 which is spectrally filtered from the temperature sensor region 24 such that it can be used as a reference reflector on the cube sensor." (col. 1, line 65 - col. 2, line 6). Thus, Foss '426 uses a reference surface to account for changes in atmospheric transmission and array or window contamination; this has nothing to do with properties being measured, it has only to do with reflectivity compensation.

Claims 1, 3, 6, 10, 13, 17 and 18 have been rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,550,516

to Burns et al., hereinafter Burns '516. This rejection is respectfully traversed.

Burns '516 discloses "a resonant strain transducer which can be augmented by an appropriate microstructure to measure pressure, acceleration, force and other applied stimuli." (col. 1, lines 51-54). "Depending on the design of the microstructure formed monolithically with the microbeam, the induced strain can be caused by and not limited to pressure, acceleration, temperature, air flow or humidity." (col. 2, lines 41-44). Thus, Burns '516 is directed to measuring pressure, acceleration, force, other applied stimuli, and acceleration, temperature, air flow, and humidity, but not radiation. Burns '516 doesn't show radiation detection as recited by the claims. In col. 9, line 67 through col. 10, line 1, Burns '516 states, "Such microbeam structure 150 has application as a temperature sensor as the resonance frequency of structure 150 would change with respect to the temperature of structure 150." Again, ambient temperature measurement is not radiation measurement.

In light of these remarks, Applicants respectfully submit that the rejection under 35 U.S.C. §102 is overcome.

VIII. Rejection Under 35 U.S.C. § 103

Claims 8, 20, 21 and 25 have been rejected under 35 U.S.C. § 103 as being unpatentable over Foss '426. Claims 9 and 14-16 have

been rejected as being unpatentable over Burns '516. This rejection is respectfully traversed.

It is respectfully submitted that neither Foss '426 nor Burns '516 is directed to the radiation detection art to which Applicants' claims are specifically directed. It is submitted that a skilled artisan reading such cited patents would not have appreciated the problem discovered and solved by the present Applicants, i.e., the problem of detecting radiation. If there is no appreciation of the problem, it is submitted that there can be no suggestion (express, implied or otherwise) to use or combine the teachings of the references to solve such problem, thus to arrive at Applicants' claimed invention.

In light of these remarks, Applicants believe that the rejection under 35 U.S.C. § 103 is overcome.

IX. Conclusion


Since the claims point out new and unobvious features not found in nor suggested by the references cited by the Examiner, reconsideration and allowance of the claims are requested.

A one (1) month extension of time is believed to be necessary and has been filed concurrently herewith.

The Commissioner is hereby authorized to charge any additional fees which may be required for this amendment, or credit any overpayment to Deposit Account No. 13-4503, Order No. 2240-7141.

In the event that an extension of time is required, or which may be required in addition to that requested in a petition for an extension of time, the Commissioner is requested to grant a petition for that extension of time which is required to make this response timely and is hereby authorized to charge any fee for such an extension of time or credit any overpayment for an extension of time to Deposit Account No. 13-4503, Order No. 2240-7141.

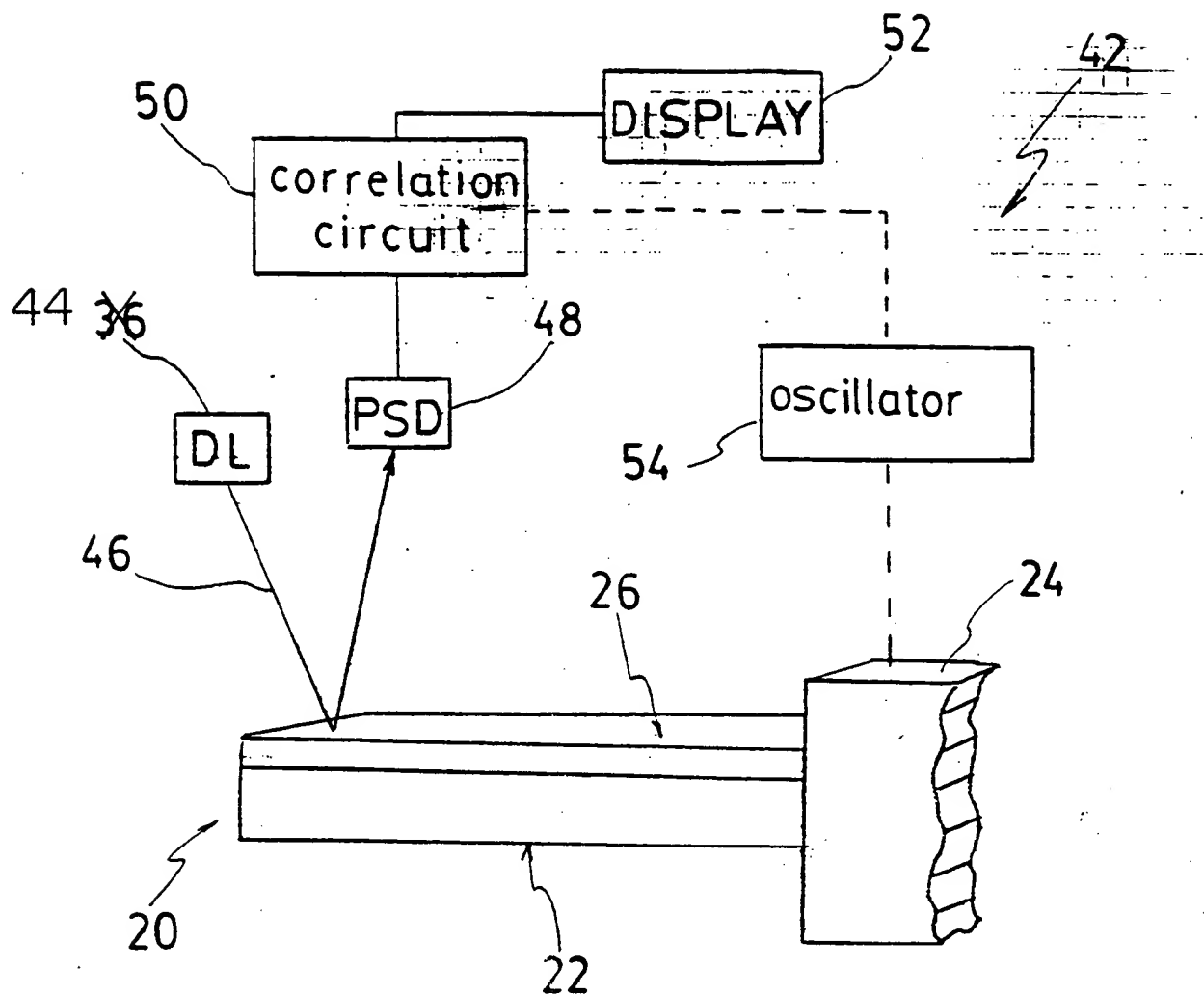
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FIG. 7



approved ✓

FIG. 8

